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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,382	11/25/2003	Gordon Munns	3165.41USU1	8003
33072	7590	09/09/2005	EXAMINER	
KAGAN BINDER, PLLC SUITE 200, MAPLE ISLAND BUILDING 221 MAIN STREET NORTH STILLWATER, MN 55082			WARREN, MATTHEW E	
			ART UNIT	PAPER NUMBER
			2815	

DATE MAILED: 09/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/723,382

Applicant(s)

MUNNS, GORDON

Examiner

Matthew E. Warren

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 June 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 16-30 is/are rejected.
- 7) ☒ Claim(s) 10-15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to the Amendment filed on June 13, 2005.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-9 and 16-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Udagawa et al. (US 6,462,361 B1) in view of Flynn et al. (US Pub. 2003/0178633 A1).

In re claims 1, 17, and 24, Udagawa et al. shows (figs. 5 and 6) a heterojunction field effect transistor (col. 1, lines 15-21) device comprising: a substrate (801) a buffer region (802) positioned upon said substrate, wherein said buffer region comprises an upper buffer region (802b) and a lower buffer region (802b) (see col. 14, lines 34-54 for explanation of upper and lower buffer regions); a heterojunction region (803-806) positioned upon said buffer region; and a superlattice (802a) positioned between said lower buffer region and said upper buffer region. Udagawa et al. shows all of the elements of the claims except the superlattice comprising alternating layers of GaN and $\text{Al}_x\text{Ga}_{1-x}\text{N}$. Flynn et al. shows (fig. 3) a heterojunction transistor comprising a superlattice structure having layers of GaN and $\text{Al}_x\text{Ga}_{1-x}\text{N}$. Flynn explains that Group III/V nitride semiconductor materials are useful in FETS because of their high thermal

conductivities and large electrical breakdowns [0004-0005]. The invention employs GaN and AlGa_N materials to improve electron mobility and enhance device reliability and device performance. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the superlattice structure of Udagawa by substituting the material layers with GaN and AlGa_N as taught by Flynn to improve electron mobility and enhance device reliability and device performance.

Also in re claims 16, 17, and 24, Flynn additionally discloses [0072] that the substrate may comprise, sapphire, SiC, or other suitable substrate materials (such as silicon, which is well known as a substrate material).

In re claims 2, 3, 18, and 25, Flynn discloses [0021] that x is from about 0.01 to 0.40.

In re claims 4, 5, 19, 20, 26, and 27, Udagawa discloses (col. 13, lines 50-67) that the superlattice comprises the range of 2-500 individual layers.

In re claims 6 and 7, neither reference discloses the thickness of the upper and lower buffer layers, however it would have been obvious to one of ordinary skill in the art to make the thickness of the buffer layers within the desired range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

In re claim 8, Udagawa discloses (col. 13, lines 50-67) that the layers of the superlattice are about 10 nm (100 Angstroms), which is between 5 and 200 Angstroms thick.

In re claim 9, Udagawa shows (fig. 6) that the heterojunction region comprises a first and second layer (803 and 804), wherein the second layer is positioned directly above the buffer and the first layer is positioned directly above the second layer.

In re claims 21, 22, 28 and 29 as far as understood, Flynn discloses [0072-0073] that a buffer layer comprises AlN and GaN. The AlN layer is about 400 Angstroms thick, which is within the same order as 300 Angstroms.

In re claims 23 and 30, neither reference specifically discloses the desired thickness of the GaN and AlGaIn layers, however it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the GaN and AlGaIn of any desired thickness, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Allowable Subject Matter

Claims 10-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant's arguments filed with respect to claims 1-9 and 16-30 have been fully considered but they are not persuasive. The applicant primarily asserts that Udagawa et al cannot be combined with Flynn et al. because the two devices in each reference are

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different or non-analogous. The examiner believes that the prior art references are combinable and that the combined references show all of the elements of the claims. Although the applicant argues that gallium arsenide material system of Udagawa is fundamentally distinct from the gallium nitride system of Flynn, both devices are analogous because they are both heterojunction field effect transistors. The two devices are not totally distinct, mutually exclusive, or incompatible. Its not as if a car engine is being combined with a typewriter. These devices only have minor differences between them. The basic structure is the same but the materials of the superlattice structure is what differs. The transistor of Udagawa lacked the teaching of gallium nitride layers and Flynn showed that the use of gallium nitride improves the electron mobility. It is well known in the art that the doping of the layers in the heterojunction device affects the lattice constants, band gaps, etc. and that different materials and elements have been added to the superlattice layers to achieve a desired operational effect. In this case, Flynn teaches that gallium nitride layers improve electron mobility. One of ordinary skill in the art would use such a teaching to improve their basic heterojunction field effect device by simply substituting gallium arsenide with gallium nitride layers. The motivation for combining these analogous references has been shown and the combined references show all of the elements of the claims. This action is therefore made final.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (571) 272-1737. The examiner can normally be reached on Mon-Thur and alternating Fri 9:00-5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MEW

September 6, 2005


TOM THOMAS
SUPERVISORY PATENT EXAMINER